Region VIII

Table 1. Ozone Nonattainment Areas - Air Quality Update, 1991-93

State	Nonattainment Area Name	Clean Air Act Classification	1991-93 Update		1993	1993
			A.Q. Value	Average Est. Exc.	2nd Daily Max 1-hr	Estimated Exceedances
UT	Salt Lake City-Ogden NA Area	Moderate	0.106	0.0	0.104	0.0

Region IX

Table 1. Ozone Nonattainment Areas - Air Quality Update, 1991-93

State	Nonattainment Area Name	Clean Air Act Classification	1991-93 Update A.Q. Value	1991-93 Update Average Est. Exc.	1993 2nd Daily Max 1-hr	1993 Estimated Exceedances
AZ	Phoenix	Moderate	0.147	4.0 (#4)	0.126	2.0
CA	Los Angeles South Coast Air Basin	Extreme	0.300	104.3	0.250	97.6
CA	Monterey Bay Unified NA Area	Moderate	0.108	0.4	0.104	0.0
CA	Sacramento Metro NA Area	Serious	0.150	9.7	0.150	3.6
CA	San Diego NA Area	Severe 15	0.150	11.8	0.160	4.0
CA	San Francisco-Bay NA Area	Moderate	0.120	0.7	0.130	2.0
CA	San Joaquin Valley NA Area	Serious	0.160	18.9	0.160	27.5
CA	Santa Barbara-Santa Maria-Lompoc	Moderate	0.123	1.0	0.114	0.0
CA	Southeast Desert Modified AQMD	Severe 17	0.200	59.3	0.180	72.6
CA	Ventura Co NA Area	Severe 15	0.150	15.9	0.144	9.0
NV	Reno	Marginal	0.089	0.0	0.089	0.0

Region X

Table 1. Ozone Nonattainment Areas - Air Quality Update, 1991-93

State	Nonattainment Area Name	Clean Air Act Classification	1991-93 Update A.Q. Value	1991-93 Update Average Est. Exc.	1993 2nd Daily Max 1-hr	1993 Estimated Exceedances
OR	Portland-Vancouver AQMA NA Area	Marginal	0.108	0.7	0.103	0.0
WA	Seattle - Tacoma NA Area	Marginal	0.105	0.0	0.100	0.0

SOURCE: EPA's air quality data system, the Aerometric Information Retrieval System (AIRS), with supplemental data from EPA Regional Offices.

NOTES:

1. Designations and classifications for ozone nonattainment areas as published in the Federal Register, 40 CFR Part 81. *Unclassified and transitional nonattainment areas are not included in this listing.*

2. The updated air quality value is estimated for the 1991-93 period using EPA guidance for calculating design values (Laxton Memorandum, June 18, 1990). Generally, the fourth highest monitored value with 3 complete years of data is selected as the updated air quality value because the standard allows one exceedance for each year. It is important to note that the 1990 Clean Air Act Amendments required that O_3 nonattainment areas be classified on the basis of the design value at the time the Amendments were passed, generally the 1987-89 period was used.

3. The National Ambient Air Quality standard for ozone is 0.12 parts per million (ppm) daily maximum 1-hour average not to be exceeded more than once per year on average. The average estimated number of exceedances column shows the number of days the 0.12 ppm standard was exceeded on average at the site recording the highest updated air quality value. This is done after adjustment for incomplete, or missing days, during the 3-year period, 1991-93. The last two columns contain data from the site recording the highest second daily maximum 1-hour concentration in 1993. The last column shows the estimated exceedances for 1993 at the site recording the highest second maximum 1-hour concentration listed in the previous column.

4. Special purpose monitoring (SPM) operating during the ozone monitoring season.

5. The nonattainment/updated air quality value site for the Chicago NA Area is in Kenosha County, WI.

6. The Regional Office is reviewing the status of the area based on data through 1994.

7. Incomplete data reported in 1991.

8. Calculation of the updated air quality value and estimated exceedances adjusted to account for start-up of a LMOS Study site with data only in 1991.

9. Data from a monitoring site located at the water treatment plant not used due to localized interference.

10. The site was located atop Whitetop Mountain, VA as part of the Mountain Cloud Study. Site elevation is 5520 feet. No data reported after 1988. This is a rural transport area. The nonattainment area is that portion of Whitetop Mountain above 4500 feet elevation.

11. Calculation of estimated exceedances adjusted for Wisconsin ozone season not yet reflected in AIRS.

APPENDIX G

LISTING OF MUNICIPAL SOLID WASTE LANDFILL ORGANIZATIONS AND RELATED SERVICE PROVIDERS

Listing of Municipal Solid Waste Landfill Organizations and Related Service Providers

Solid Waste Association of North America (SWANA)
P.O. Box 7219
Silver Spring, MD 20910-7219
Contact: Michael Ohlsen
Phone: (301) 585-2989
Fax: (301) 585-7068

Environmental Industry Associations (EIA)/ National Solid Wastes Management Association (NSWMA)
4301 Connecticut Avenue, NW
Suite 300
Washington, DC 20008
Contact: Ed Repa
Phone: (202) 244-4700
Fax: (202) 966-4818

Association of State and Territorial Solid Waste Management Officials (ASTSWMO)
Hall of States
Suite 343
444 North Capitol Street, NW
Washington, DC 20001
Phone: (202) 624-5828
Fax: (202) 624-7875

National Business Industries Association
122 C Street, NW
Fourth Floor
Washington, DC 20001
Phone: (202) 383-2540
Fax: (202) 383-2670

Department of Energy Regional Biomass Energy Program
Office of National Programs
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
Contact: N. Michael Voorhies, National Coordinator
Phone: (202) 586-9104

American Public Works Association
1301 Pennsylvania Avenue, NW
Suite 501
Washington, DC 20004
Contact: Sarah Layton
Phone: (202) 347-0612
Fax: (202) 737-9153

<u>Regional Biomass Energy Programs:</u>

Northeast Region
Richard Handley, Program Manager
CONEG Policy Research Center, Inc.
400 North Capitol Street, NW
Suite 382
Washington, DC 20001
Phone: (202) 624-8454
Fax: (202) 624-8463

Northwest Region
Jeff James, Program Manager
U.S. Department of Energy
Seattle Regional Support Office
905 NE 11th Avenue
Portland, OR 97232
Phone: (503) 230-3449
Fax: (503) 230-4973

Regional Biomass Energy Programs (continued):

Great Lakes Region
Frederick J. Kuzel
Council of Great Lakes Governors
35 East Wacker Drive #1850
Chicago, IL 60601
Phone: (312) 407-0177
Fax: (312) 407-0038

Southeast Region
Philip Badger, Program Manager
Tennessee Valley Authority
435 Chemical Engineering Building
Muscle Shoals, AL 35660
Phone: (205) 386-3086
Fax: (205) 386-2963

Western Region
Dave Swanson
Western Area Power Authority
1627 Cole Boulevard
P.O. Box 3402
Golden, CO 80401
Phone: (303) 231-1615
Fax: (303) 231-1632

APPENDIX H

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APPENDIX I

ACID RAIN FACT SHEET

United States Environmental Protection Agency
Air and Radiation (6204-J)
EPA 430-K-94-014
November 1994

Landfill Methane and Clean Air Act Opportunities

Incentives from the Acid Rain Program

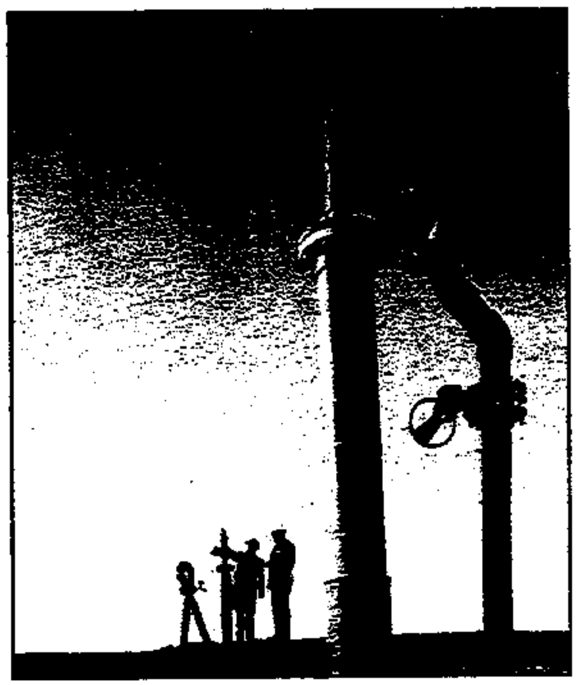


Photo courtesy of New England Electric System

The environmental benefits of generating electricity from landfill methane now have an added, quantifiable value. Through an innovative system of tradeable emission allowances, Title IV of the Clean Air Act has increased the value of electricity generated from landfill methane.

ACID RAIN PROGRAM

Methane gas emissions from our country's growing landfill sites are a serious threat to greenhouse gas stabilization. Capturing methane from landfill sites for electrical generation serves both economic and environmental goals. Landfill methane is already a cost-effective energy resource in many areas of the country. The Clean Air Act incentives will further enhance the cost-effectiveness of landfill methane energy projects.

The Clean Air Act Incentives

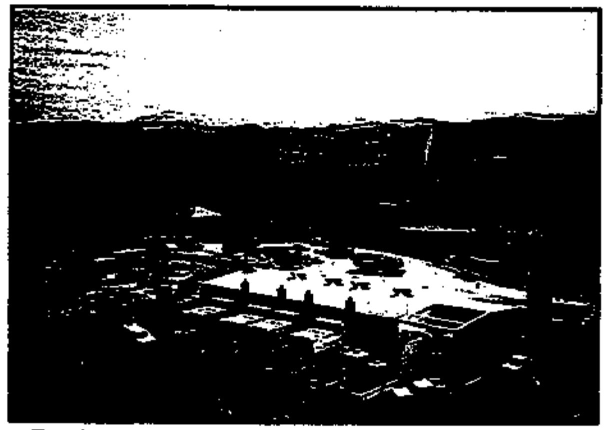
The 1990 Clean Air Act Amendments call for a 10 million ton annual reduction in national SO_2 emissions from 1980 levels. This program creates a new tradeable commodity, the SO_2 emission allowance. Each allowance represents an authorization to emit one ton of SO_2 (i.e., a unit that emits 5,000 tons of SO_2 must hold at least 5,000 allowances that are usable that year). By avoiding the emission of SO_2 with landfill methane systems, utilities will both earn and save tradeable emission allowances. And these emission allowances have a real market value.

To promote pollution prevention, Title IV of the Clean Air Act includes two incentives for energy efficiency and renewable energy. These incentives are:

1. Avoided emissions

2. Conservation and Renewable Energy Reserve

Avoided emissions is perhaps the most lucrative of the incentives; each ton of SO_2 avoided through the generation of electricity from landfill methane saves one emission allowance. Allowances are saved at the utility's own rate of emissions. The avoided emissions incentive is automatic; there are no application or verification requirements.



The Sonoma County, California landfill gas-to-energy facility. Photo courtesy of Landfill Energy Systems.

The Conservation and Renewable Energy Reserve is a special bonus pool of 300,000 allowances set aside to reward new initiatives in technologies such as landfill methane. For every 500 MWh of electricity generated through landfill methane systems, a utility earns one allowance from the Reserve.

For more information on these incentives, see *Energy Efficiency and Renewable Energy: Opportunities from Title IV of the Clean Air Act.*[1]

1. US EPA, *Energy Efficiency and Renewable Energy: Opportunities from Title IV of the Clean Air Act,* Document no. EPA 430-R-94-001, February 1994. To obtain a copy, contact the Acid Rain Hotline at (202) 233-9620.

Valuing the Incentives

In general, the value of the Clean Air Act incentives will be the number of allowances earned or saved by the landfill methane installation multiplied by the market price of an SO_2 emission allowance. The hypothetical example below illustrates the potential savings from the Clean Air Act incentives.[2]

The market for tradeable emission allowances is continuing to evolve. A recent report issued by the Electric Power Research Institute (EPRI) indicates that prices could rise from $250 per allowance in 1995 to $480 per allowance in 2007.[3] Price signals are also being provided by private trades and trading exchanges.

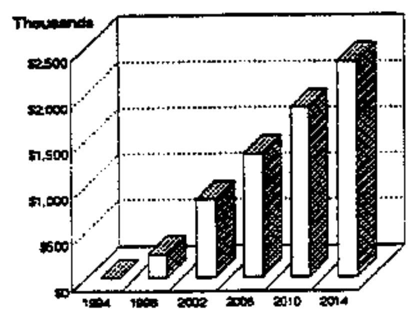
Example

In 1994, a utility installs 7 MW of capacity from landfill methane sites. The utility will enter the Acid Rain Program in the year 2000, and thus is eligible to earn Reserve allowances until 2000. Assuming a typical capacity factor of 0.85, the value of the Reserve allowances is calculated as follows:

7 MW x 8,760 hours/yr x 0.85 = 52,122 MWh/yr
52,122 MWh/yr ÷ 500 MWh/allowance = 104 allow./yr
$250/allowance x 104 allowances/yr = $26,000/yr

Thus, for the six years from 1994 through 1999, the utility could earn $156,000 from the Reserve alone. However, landfill methane will continue to add value in the year 2000 and beyond through the avoided emissions incentive. And the benefits from avoided emissions will be even greater than those from the Reserve.

Cumulative Value of the SO_2 Incentives



Assuming the utility's marginal rate of SO_2 emissions is 1.2 lbs/mmBtu (the emission limit for the Acid Rain Program) and a typical heat rate of 10,000 Btu/kWh, the value of avoided emissions in the year 2000 is:

1.2 lbs/mmBtu x 10,000 Btu/kWh x mmBtu/1,000,000 Btu = 0.012 lbs/kWh
52,122,000 kWh x 0.012 lbs/kWh x 1 ton/2000 lbs = 313 tons = 313 allowances
313 allowances x $340/allowance = $106,420

Assuming a 20 year project life and a 6% discount factor, the net present value of the Clean Air Act incentives for this landfill methane project is $980,000.

Since landfill methane is a local resource, transmission losses are reduced and thus further improve the project's cost-effectiveness.

2. For a more detailed explanation of the calculations in this example, contact the Acid Rain Hotline at (202) 233-9620 and ask for the *Landfill Methane Example*.

3. EPRI, *Integrated Analysis of Fuel, Technology and Emission Allowance Markets: Electric Utility Responses to the Clean Air Act Amendments of 1990*, Report no. TR-102510, August 1993, p. 1-20.

	1995	2000	2003	2007
Price ($/ton)	$250	$340	$400	$480

Utility Allies: Tapping the Potential of Landfill Methane

By purchasing electricity generated from landfill gas, utilities gain a clean, renewable energy source, produce valuable reductions in local air pollutants and greenhouse gases, and build a more diverse and local resource base. To mobilize the use of landfill gas as an energy resource, EPA has created the Landfill Methane Outreach Program.

To become a Utility Ally in this program, a utility agrees to take advantage of the best opportunities for obtaining power from landfill gas. In turn, EPA recognizes and publicizes the utility's efforts and can assist in the evaluation and development of projects. The result is a win for the utility and its customers, and a win for the environment and the economy.

LANDFILL METHANE OUTREACH PROGRAM

EPA estimates that over 700 landfills across the US could install economically viable landfill gas energy recovery systems, yet only about 115 facilities are in place. The EPA Landfill Methane Outreach Program is working to overcome the informational, regulatory, and other barriers that prevent these otherwise economical projects from going forward.

For more information on how your utility can become a Utility Ally, please contact EPA's Landfill Methane Program at (202) 233-9042.

Complying Cost-Effectively

Landfill methane resources can be cost-effective components to an integrated compliance strategy by:

- Complementing or offsetting the use of other compliance strategies such as fuel-switching;
- Delaying or eliminating the need for expensive alternative strategies such as scrubbing;
- Helping to avoid the noncompliance penalty of $2,000 per ton of SO_2; and
- Increasing revenues through the sale of extra allowances.

The extent to which the Clean Air Act incentives affect the financial outlook of landfill methane systems will depend upon each utility's own circumstances. Utilities that currently emit high levels of SO_2 can benefit significantly from the incentives. However, even utilities already in compliance can benefit from the revenues generated from extra allowances.

Emissions from fossil fuel generation harm waters and forests, endanger animal species, accelerate the decay of buildings and monuments, and impair public health. In many sensitive lakes and streams acidification has completely eradicated fish species.

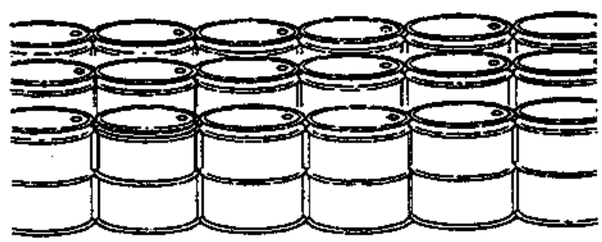
Research has pointed to the increased health risks from particulate matter, which includes sulfates and other pollutants emitted during the combustion of fossil fuels. A recent study by Harvard University's School of Public Health linked these emissions to higher mortality rates and lung dysfunction in children and other sensitive populations.[4]

Emissions from fossil-fuel sources have damaged many forests.

Electricity generated from landfill methane helps combat not only acid rain, but other environmental harms as well, including global climate change. Landfill methane systems avoid emissions of SO_2, toxics, and particulates, as well as the production of ash and scrubber sludge.

Electricity generated from landfill methane will also help minimize emissions affecting global climate change. Not only does this resource offset emissions from fossil fuel energy generation, but it also prevents the escape of methane gas, a greenhouse gas that is over 20 times more potent than carbon dioxide. Every 10,000 kilowatt hours of electricity generated from landfill methane is equivalent to:[5]

Planting 23,680 Trees per Year, or



Eliminating 360 Barrels of Crude Oil

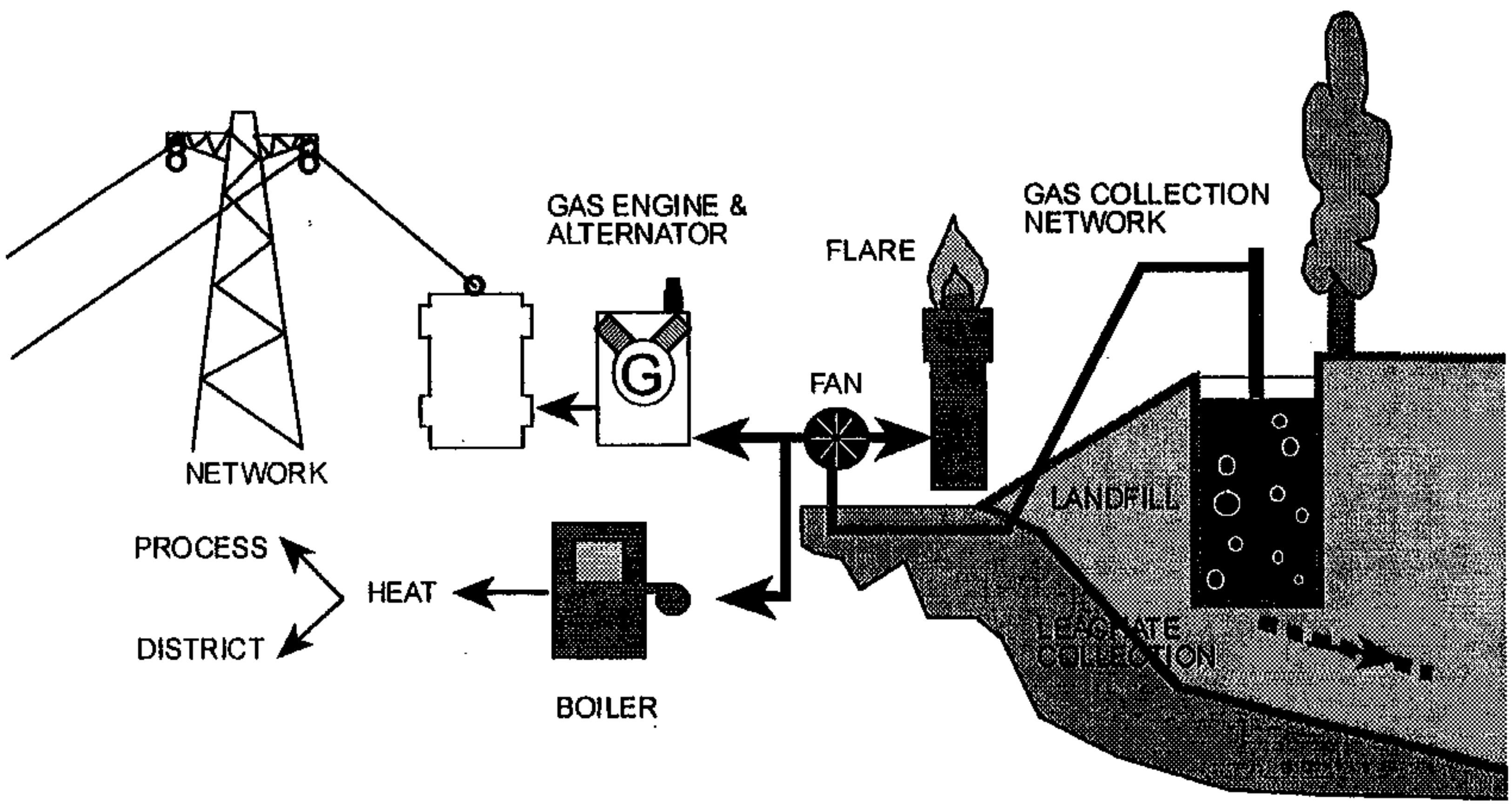
Landfill methane systems can be cost-effective solutions for simultaneously eliminating multiple pollutants. Rather than installing costly controls for each pollutant, landfill methane technology can be a solution for many pollutants. Landfill methane systems also provide insurance against the risk of future environmental regulations, including regulations on greenhouse gas emissions.

The real, quantifiable value of the Clean Air Act incentives can maximize a utility's overall cost-effectiveness in serving its customers and protecting the environment.

4. Dockery, Douglas W., et al., *An Association between Air Pollution and Mortality in Six US Cities*, The New England Journal of Medicine, vol. 329, no. 24, December 9, 1993, p. 1753-9.

5. Based on the 1990 average CO_2 emission rate for US utility generation.

Landfill Methane Recovery Process



Landfill gas is generated naturally through the bacterial decomposition of organic matter deposited in a sanitary landfill. Gas collection systems pull the gas from a series of wells to a central processing facility. Landfill gas is typically a medium Btu gas that has a number of energy applications. The most prevalent use is production of electricity for sale to the local utility. The gas may also be employed directly for use as boiler fuel and industrial process heat or converted for use as compressed natural gas for vehicle fuel.

Utility Profile: Detroit Edison Company

As the landfill gas recovery industry evolved in the 1980s, Detroit Edison became active in developing Michigan's first landfill gas-fired combustion turbine generating station. The 6.6-megawatt facility has safely and reliably operated at more than 85 percent capacity since achieving commercial operation in 1988.

Sited on a landfill owned by the City of Riverview, 20 miles south of Detroit, the small power production facility uses enough methane gas to generate electricity for about 6,000 homes. More than 100 gas wells on the 150-acre site collect about 4.3-million cubic feet of landfill gas daily to generate the power, which is sold to Detroit Edison.

Riverview, Michigan landfill gas-to-energy facility

While the project's 225,000 megawatt-hours of electricity is a small portion of Detroit Edison's overall power production, the environmental significance is impressive. By capturing more than 8 million cubic feet of landfill gas, this project has prevented more than 1,200 tons of sulfur dioxide emissions which would have been produced by fossil-fueled power generation. Each day the project directly destroys more than 2 million cubic feet of methane, a potent greenhouse gas.

Detroit Edison's involvement with 120-acre Sonoma Central landfill in California is relatively new. Through a subsidiary, landfill gas is collected, cleaned, compressed and delivered as fuel to a plant producing 3.2 megawatts. Sonoma County, owner of the facility, has been selling the electricity since May 1993. The facility uses about 1,200 cubic feet per minute of landfill gas to produce its power.

The Riverview and Sonoma facilities are licensed to operate well into the 21st century. Their success has prompted Detroit Edison to pursue similar ventures in Florida, Illinois, Texas, Ohio, and elsewhere in Michigan.

For More Information

Write to:

US Environmental Protection Agency
Acid Rain Division (6204J)
Energy Efficiency and Renewable Energy
Section
401 M Street, SW
Washington, DC 20460

If you have further questions or would like to receive any other publications, please call the Acid Rain Hotline at (202) 233-9620. An Energy Efficiency and Renewable Energy staff member will return your call within 24 hours.

APPENDIX J

GLOSSARY OF TERMS

Glossary of Terms

AFFECTED LANDFILL: Landfills that meet criteria set by the EPA under authority of Title I of the Clean Air Act for capacity, age, and emission rates; affected landfills are required to collect and combust their landfill gas

ATTAINMENT AREA: A geographic region that meets National Ambient Air Quality Standards (NAAQS) for specific air pollutants

AVOIDED COST: The cost a utility would incur to generate the next increment of electric capacity using its own resources; many landfill gas projects' buyback rates are based on avoided costs

BASELOAD: A term referring to the energy use of a facility that has a consistent, year-round need for energy; baseload can also refer to the minimum amount of electricity supplied to a facility on a continuous basis

BEST AVAILABLE CONTROL TECHNOLOGY (BACT): The most stringent technology available for controlling emissions; major sources are required to use BACT, unless it can be demonstrated that it is not feasible due to energy, environmental, or economic reasons

BUYBACK RATE: The price a utility will pay a third party supplier for electricity or gas

CAPACITY FACTOR: The ratio of the energy produced by a piece of equipment during a given time period to the energy the unit could have produced if it had been operating at its full rated capacity

CAPACITY PRICE: The fixed price in $/kW a utility pays a third party supplier for a guaranteed availability of generating capacity; capacity price is based on the capital costs of a generating unit

CAPITAL CHARGE RATE: A number used to convert the installed cost of a power project into a levelized capital cost that can be charged to the project in each year of the project life

CAPITAL COST: The total installed cost of equipment, emissions control, interconnections, gas compression, engineering, soft costs, etc. for landfill gas projects

COGENERATION: The consecutive generation of useful thermal energy and electric energy from the same fuel source

COMBINED-CYCLE: Technology in which waste heat from a gas turbine is used to produce steam in a waste-heat boiler; the steam is then used to generate electricity in a steam turbine/generator

CONDENSATE: Liquid formed when warm landfill gas cools as it travels through the collection system

COST OF CAPITAL: The cost to a company of acquiring funds to finance the company's capital investments and operations

DEBT COVERAGE RATIO: Ratio of operating income to debt service requirement, usually calculated on an annual basis

DEBT SERVICE REQUIREMENT: Monthly requirement to meet the principal and interest amounts of a loan

DISPLACEMENT SAVINGS: Savings realized by displacing purchases of natural gas or electricity from a local utility by using landfill gas

EPC FIRM: A company that provides engineering, procurement, and construction services

FLARE: A device used to combust excess landfill gas that is not used in energy recovery; flares may be open or enclosed

GREENHOUSE GAS: A gas, such as carbon dioxide or methane, which contributes to global warming

GROSS POWER GENERATION POTENTIAL: The installed power generation capacity that landfill gas flows can support

HEAT RATE: A measure of generating unit thermal efficiency, expressed in units of Btu/kWh

LOWEST ACHIEVABLE EMISSIONS RATE (LAER): The most stringent technology available for controlling emissions; major sources are required to use LAER (cost is not a consideration in determining the LAER technology)

MAJOR SOURCE: New emissions sources or modifications to existing emissions sources that exceed NAAQS emission levels

METHANE (CH_4): The major component of natural gas and landfill gas; produced in landfills when organic matter in waste decomposes

METRIC TON: Measurement of mass; one metric ton equals one megagram (Mg)

MINOR SOURCE: New emissions sources or modifications to existing emission sources that do not exceed NAAQS emission levels

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS): Air quality standards, established by the Clean Air Act, for six criteria pollutants

NET PRESENT VALUE (NPV): The amount of money, that if invested today at a given rate of return, would be equivalent to a fixed amount to be received at a specified future time

NEW SOURCE REVIEW (NSR): Process by which an air quality regulatory agency evaluates an application for a permit to construct a new generating facility

NONATTAINMENT AREA: A geographic region designated by the EPA that exceeds NAAQS for one or more criteria pollutants

NON-METHANE ORGANIC COMPOUNDS (NMOCs): Compounds found in landfill gas which affect human health and vegetation; NMOCs include several compounds that are known carcinogens to humans

PARASITIC LOAD: The electric load required to run generation equipment; contributes to the difference between gross and net output

PREVENTION OF SIGNIFICANT DETERIORATION (PSD): Regulations designed to limit the increase of criteria air pollutants in attainment areas

PRO FORMA: A computer model of project cash flows over the life of the project, usually containing several standard items

PROJECT FINANCE: A method for obtaining commercial debt financing for the construction of a facility where lenders look to the creditworthiness of the facility to ensure debt repayment, rather than to the assets of the project developer

PUMP TEST: A procedure used to determine the gas generation rate of a landfill; it involves drilling test wells and installing pressure probes

PUBLIC UTILITIES REGULATORY POLICIES ACT (PURPA): Act that requires utilities to purchase the electric output from QFs at the utility's avoided cost

QUALIFYING FACILITY (QF): A cogenerator or small power producer, as defined by PURPA, that is entitled to special regulatory treatment; utilities are required to purchase the electrical output from QFs at the utility's avoided cost

RATE OF RETURN (ROR) ON EQUITY: Financial measurement used to judge the percent of return on equity capital used in business

RENEWABLE ENERGY PRODUCTION INCENTIVE (REPI): Incentive established by the Energy Policy Act, that is available to renewable energy power projects owned by a state or local government or nonprofit electric cooperative

REQUEST FOR PROPOSALS (RFP): A solicitation by a utility for project proposals

ROYALTIES: Compensation given to a landfill owner for gas rights

SENIOR DEBT LENDER: Institution or person who lends money with the intention that the debt will be repaid before project earnings get distributed to equity investors

SOFT COSTS: Transaction and legal costs, escalation during construction, interest during construction, and contingency costs associated with a project

STANDARD OFFER: A power purchase agreement, sanctioned by the state utility commission, that is typically based on avoided costs

SUBORDINATED DEBT: Money that is repaid after any senior debt lenders are paid and before equity investors are paid

VOLATILE ORGANIC CHEMICALS (VOCs): Chemicals found in landfill gas that are contributors to smog

WHEELING: The transmission of electricity owned by one entity using the facilities owned by another entity (usually a utility)